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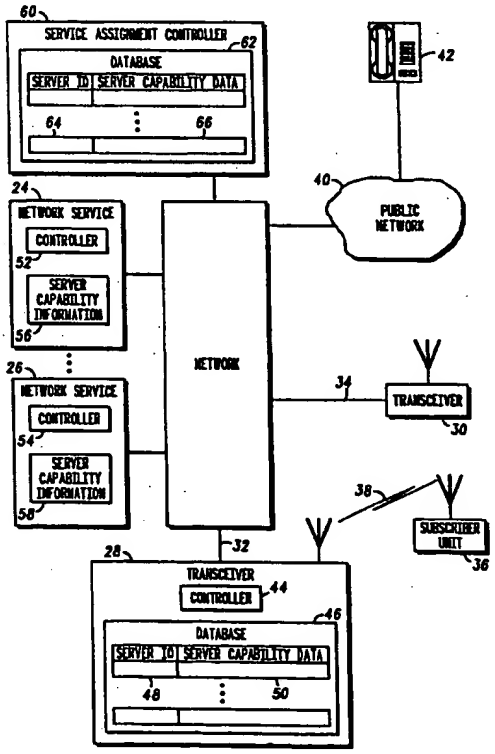
(54) Title: METHOD AND SYSTEM FOR NETWORK SERVICE NEGOTIATION IN A TELECOMMUNICATIONS SYSTEM



(57) Abstract: In a telecommunication system, a network service is negotiated by frost receiving, in a service assignment controller (60) coupled to a network, server capability information relating to a plurality of network service elements (24, 26) coupled to the network. Next, one of the plurality of network service elements is selected in response to the received server capability information. Thereafter a service request is sent to the selected one of the plurality of network service elements. The service assignment controller may be in the network service element, in a client requesting the network service, or in a separate device coupled to the network.

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METHOD AND SYSTEM FOR NETWORK SERVICE NEGOTIATION IN A TELECOMMUNICATIONS SYSTEM

Related Applications

The following applications are related to this application and are filed on the date herewith. The disclosure of each of these related applications is incorporated by reference: S/N (Docket Number CE08072R) titled "METHOD FOR CHANGING COMMUNICATION IN A COMMUNICATION SYSTEM, AND COMMUNICATION SYSTEM THEREFOR"; S/N (Docket Number CE08136R) titled "METHOD FOR ESTABLISHING COMMUNICATION IN A PACKET NETWORK"; S/N (Docket Number CE08135R) titled "METHOD FOR RETRANSMITTING A DATA PACKET IN A PACKET NETWORK"; S/N (Docket Number CE08170R) titled "COMMUNICATION NETWORK METHOD AND APPARATUS"; S/N (Docket Number CE08169R titled "METHOD AND SYSTEM FOR PROCESSING INTELLIGENT NETWORK COMMANDS IN A COMMUNICATIONS NETWORK"; S/N (Docket Number CE08193R) titled "SESSION BASED BILLING IN A COMMUNICATION SYSTEM"; S/N (Docket Number CE08186R) titled "METHOD AND APPARATUS FOR ROUTING PACKET DATA IN A COMMUNICATIONS SYSTEM"; S/N (Docket Number CE08190R titled "METHOD AND SYSTEM FOR INTRODUCING NEW SERVICES INTO A NETWORK".

Field of the Invention

The present invention is related in general to communications networks, and more particularly to an improved method and system for negotiating network service in a telecommunications system network.

Background of the Invention

In a communications network, functional components may be connected via communication links for providing communication services to subscribers. Within the communications network, some functional devices may be considered "client"

devices, while other devices may be considered "server" devices. Some devices of the network may be both a client and a server because it may have a client relationship with one device and a server relationship with another.

A client device may be defined as a device consisting of hardware and software that is used to contact and obtain data from, and the use of resources in, a server device. A server device may be defined as a device, implemented in software or hardware or both, that provides a specific kind of service to a client device.

Communications networks have been used to implement a cellular communications system wherein base stations are connected to base station controllers via communication links typically implemented with T1 telephone line connections, or the like. In these cellular communications system, the base station, which may also be referred to a base transceiver station (BTS), may be in a client relationship with a network service provided in a server in the base station controller (BSC). Such a network service may include a transcoder service that converts data from a format used by the base station to a format used to communicate with the public switched telephone network (PSTN). Thus, whenever a base station is involved in a call or data link between a wireless subscriber unit and another voice or data unit connected to the PSTN, the base station must use a network service provided by a transcoder in the base station controller.

In order to provide highly reliable service, it is desirable to design a communications system without single points of failure. For example, in the cellular communications system described above, the communications link between the base station and the base station controller may be a single point of failure, or the transcoder in the BSC selected for use by the base station may also present a single point of failure. In the prior art, a base station is typically connect to a single base station controller, which means such a BSC may select only transcoder services offered within that base station controller. With this configuration, the base station controller becomes a single point that may cause the call to fail.

Another problem occurs in cellular communications systems when new base stations are added to increase capacity or coverage area and these new base stations must compete with the existing base stations for network services. When base

stations are connected to particular base station controllers, a new base station that adds more capacity to an existing service area may require a new base station controller if the existing base station controller cannot provide the network service. This may put a network operator in the position of buying a base station controller to control only a fraction of the number of base station that the controller was designed to serve. This leads to inefficient use of the base station controller which costs the operator money. One way to solve this problem is to move connections between base stations and base station controllers in order to accommodate the new base station controller in a manner that distributes the load more evenly. This has the disadvantage of changing backhaul connections between the base stations and base station controller. Changing the backhaul connections is an expensive time consuming tasks. This process of changing backhaul connections and changing any data associated with such backhaul connections is often referred to as reprovisioning or reparenting.

Thus, it should be apparent that a need exists for an improved method and system for negotiating network services in a telecommunications system wherein the potential for single point failures is minimized in order to provide higher available, and highly reliable communication services and wherein the communications system is easily expanded and reprovisioned.

Brief Description of the Drawings

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objects, and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

FIG. 1 is a high-level functional block diagram of a communications system network that may be used to implement the method and system of the present invention;

FIG. 2 is a high-level logic flowchart for negotiating network service in accordance with a first embodiment of the method and system of the present invention; and

FIG. 3 is a high-level logic flowchart for implementing network service negotiation in accordance with a second embodiment of the method and system of the present invention.

Detailed Description of the Invention

With reference now to **FIG. 1**, there is depicted a high-level functional block diagram of a communications system network, which may be used to implement the method and system of the present invention. As illustrated, network **20** is coupled to network services **24** and **26**. Network services act as servers on the network and hence may be referred to as network servers.

Network **22** may be implemented with an internet protocol transport network using control computers (using H.323 or media gateway control protocol (MGCP)), signaling gateways to PSTN (e.g. SS7) and internet, and a packet transport fabric, such as ATM, IP – routers, access nodes, or the like.

An examples of network services **24** and **26** is a transcoding service which may convert data in one format to another format. These services are provided to a client by negotiating with the client and finally establishing a communication session with the client to actually provide the service.

If communication system **20** is implemented with a cellular communication system, the system will likely include transceivers coupled to network **22**, such as transceivers **28** and **30**. Such transceivers may be base stations that implement an air interface according to any one of several well known air interface standards, such as the standard for code division multiple access (CDMA) cellular communications specified in Interim Standard (IS) -95 published by the Telecommunications Industry Association.

Transceivers **28** and **30** are coupled to network **22** via communications links **32** and **34**. These communications links may be implemented with leased telephone lines, fiber optics lines, microwave links, or the like. Communication links **32** and **34** typically carry data in a format conducive to transmitting over the air to a subscriber unit, such as subscriber unit **36** that communicates with transceiver **28** via wireless communications link **38**.

Subscriber unit **36** may be a mobile handset for providing a user with voice or data communication services. Subscriber unit **36** may also be fixed, or relatively immobile, for providing local loop telephone service to homes or

businesses. Additionally, subscriber unit **36** may be a unit that primarily transfers data for applications such as point of sale vending.

Network **22** is preferably coupled to a public network, such as public network **40**, which may be implemented with the public switched telephone network (PSTN) or the internet, or both. Also shown coupled to public network **40** is consumer premise equipment (CPE) **42**, which may be a telephone, fax machine, computer modem, or the like.

Periodically within communication system **20**, transceiver **28** may need a network service provided by network service **24** or **26**. For example, if network services **24** and **26** both provide a base station controllers type function wherein both provide transcoder services for communication between subscriber unit **36** and public network **40**, transceiver **28** may select either network service **24** or **26** because network **22** may provide a communications link to either of them. Because transceiver **28** may receive transcoding services from either network service **24** or network service **26**, this eliminates a single point of failure in the design of communications system **20** that is typically found in prior art systems.

When subscriber unit **36** is communicating with CPE **42**, data flows through a communication path extending from subscriber unit **36** through wireless communications link **38** to transceiver **28**. From transceiver **28** the data path extends through communication link **32** to network **22**, which provides a path to, for example, network service **24**, which provides a transcoder function. From network service **24**, the path extends back through network **22** to public network **40**, and finally to CPE **42**. In this example, the network service may be located in the data path. Other network services may be provided as if the server was at the end of the path. Examples of this type of service include a location finding network service, a billing reporting service, or other sort of data reporting service, or the like.

According to an important aspect of the present invention, various controllers and databases may be used in order to negotiate network services in accordance with the method and system of the present invention. For example, transceiver **28** may include controller **44** and database **46**. Database **46** may be used for monitoring various network services and data that indicates the capability of these network services. Database **46** may be implemented by storing

information in fields such as server ID field **48** and server capability data field **50**. Controller **44** may be used to monitor server status and server capability data and store such data in database **46**.

Similarly, network services **24** and **26** may also include controllers **52** and **54**, respectively. Also stored within network services **24** and **26** is server capability information **56** and **58**, respectively. Controllers **52** and **54** may be used to broadcast server capability information, monitor the broadcast of server capability information from other network services, and negotiate with other network services the right to provide a service to a client, such as transceiver **28**.

In yet another embodiment, service assignment controller **60** may be coupled to network **22** for aiding in the negotiation and assignment of services to clients in communications system **20**. As shown, service assignment controller **60** may also include a database, such as database **62**. Database **62** may include server ID field **64** and server capability data field **66** like database **46** discussed above. The data stored in database **62** may be obtained by polling network services **24** and **26**, or by monitoring broadcasts mad by network services **24** and **26**.

With reference now to **FIG. 2**, there is depicted a high-level logic flowchart for implementing the method for negotiating network services in accordance with the method and system of the present invention. As illustrated, the process begins at block **100**, and thereafter passes to block **102** wherein the network services or network servers broadcast server capability information to clients in the communication system, which are implemented, in the example shown in **FIG. 1**, by transceivers **28** and **30**. This broadcast of server capability information may be implemented using internet protocol (IP) multicast techniques that cause a single packet of information to be appropriately duplicated within the equipment of network **22** so that each transceiver **28** and **30** receives a copy of the multicast packet of data.

Server capability information informs clients of the presence of a server, parameters for communicating with that server, information regarding the availability of the server for scheduling services, the load or present demand for services, information for otherwise quantifying or qualifying the service that can be expected from the network server. The cost of services provided by the server may also be included in the server capability information. Server capability

information may include server availability expressed as whether or not the server is capable of immediately responding to a request for network services.

Next, the transceiver or client receives the server capability information and builds a database to facilitate analyzing the information, as depicted at block **104**. After the data is stored in the client in the database, the process determines whether or not a service has been requested or a service is needed, as illustrated at block **106**. If a service has not been requested, the process iteratively loops via the "no" branch until a service has been requested.

If a network service has been requested, the process analyzes the database in the client and selects a network server to provide the service in response to such analysis, as depicted at block **108**. Database analysis may include finding an available network server, finding the highest quality network server, finding the lowest cost network server, finding a network server with the least load, or other similar sorting and analyzing functions.

After server selection, the client, such as the transceiver, requests the network service from the selected network server, as illustrated at block **110**. This step may be implemented by sending a message to the selected network server that indicates that the requesting client, such as a transceiver, requires the network service offered by the selected network server.

Finally, for the purpose of providing the service, the process establishes a network connection or a network session between the client and the selected network service, as depicted at block **112**. Part of establishing a network connection may include a message from the selected network server that acknowledges the request from the client and communicates parameters necessary to begin communicating and carrying out the network service.

Following block **112**, the process may iteratively return to block **106** to await the next request for a network service. It should be understood that the processes shown in blocks **102** and **104** may continually execute in order to maintain current sever capability information in the database.

In the embodiment illustrated in relation to **FIG. 2**, the client, which may be a transceiver in a cellular communications system, monitors information

broadcast by network servers, and makes the network server selection based upon this broadcast information and further selection logic. Other embodiments described and discussed below illustrate that the analysis and selection decision may be made different ways and in other logical places within the communication system.

With reference now to **FIG. 3**, there is depicted a high-level logic flowchart for implementing an alternate method for negotiating network services in a communications system in accordance with the method and system of the present invention. As illustrated, the process begins at block **200**, and thereafter passes to block **202**, wherein each network server broadcasts server capability information to the other servers connected to the network. With reference to **FIG. 1**, this step may be implemented when network service **24** broadcasts server capability information, such as shown at reference numeral **56**, to other servers, such as network service **26**. The broadcast of this server capability information may be implemented using internet protocol multicast techniques in network **22**. The server capability information **56** has been discussed with reference to **FIG. 2**, above.

Each network server receives server capability information and builds a database to organize such information in each server, as illustrated at block **204**. The database may be organized in a manner similar to that discussed in relation to database **46** in **FIG. 1**.

Next, the process determines whether or not a network service has been requested, as depicted at block **206**. If a network service has not been requested, the process waits for such a request, as indicated by the "no" branch from block **206**.

If a network service has been requested by a client, each network server receives the broadcast request for service that was broadcast by the requesting client, as illustrated at block **208**.

Next, in each network server, the database is analyzed and the network servers agree upon the selection of the network server to respond to and fulfill the request for service from the client, as depicted at block **210**. In one embodiment, the analyzing referenced in block **210** may be implemented with a sort in the

database on a selected field representing server capability information. In another embodiment, part of the selection method may include a hashing operation that depends upon the identity or serial number of the subscriber unit, or perhaps upon the identity of the customer or user of the subscriber unit. In the embodiment shown in **FIG. 3**, after the analysis the servers should each reach the same conclusion regarding the selection of a network server to fulfill the service request.

Next, the selected server responds to the requesting client by sending the address of the selected server, and perhaps other communication related information, to the requesting client, such as a transceiver coupled to the network, as illustrated at block **212**. Once the requesting client (i.e., the transceiver) has been informed of the address of the a network server that will provide network service, the client establishes a network connection or session for providing a service, as depicted at block **214**.

Following block **214**, the process may iteratively return to block **206** to await the next request for a network service. It should be understood that the processes shown in blocks **202** and **204** may continually execute in order to maintain current sever capability information in the database.

The network service negotiation process shown in **FIG. 3** illustrates an embodiment of the invention where the analysis of server capability information and selection of a network server is made among the group of servers that could respond to the request for service. The advantage of this embodiment is that the client, such as the transceiver, need not know where or how many network services are available on the network when the client broadcast a request for service. Following the broadcast of the request, the client receives an offer to provide service and information about establishing a network session so that the service may be provided. In this embodiment, the transceiver or client need not monitor network traffic relating to the server capability information of all servers that may fulfill a service request in order to maintain a database that may be used to select a server. In this embodiment of the invention, network services may be added without impacting the clients. Clients need not worry about managing databases or analyzing the data to make a selection.

In yet another embodiment of the present invention, service assignment controller **60** manages some or all of the network service selection process. At one

level of service, service assignment controller 60 may maintain the database of server capability information by either monitoring messages from network services 24 and 26, or polling network services 24 and 26. Once the data is gathered and organized, service assignment controller 60 is available to respond to requests for information from clients who then make their own selection based upon the information provided.

At another level of service, the client may consult service assignment controller 60 for the entire network services selection decision. For example, service assignment controller 60 may respond to a client's request for service by sending the client the selected network server's address and other communication related information.

While the present invention is shown and described in relation to a base station client seeking transcoding services from a network server, the present invention may be applied to other client server relationships in the communications network. For example, service negotiation according to the present invention may take place between a transcoder network server and a gateway network service that provides interworking service for communication with the internet.

Several advantages may be realized through the flexibility and reconfigurability gained with the present invention. By using the invention described above, a communications network may be made more robust by increasing the network's ability to function in the event of a failure of a network service. Because a base station or other client in the network can select and be connected to any network service in the network, in any physical location, and is not limited to selection of network services in a single rack of equipment or a single location, each spare or available network service plays a backup role to a larger number of clients, which number may in fact be the total number of clients in the system. This means that the number of spare units may be lower, and the cost spent to make each network server reliable may be reduced, both of which lower the cost of the overall system without sacrificing reliability. The system is also cheaper to maintain with fewer network servers.

Additionally, as clients are added to the system, and the scale of the system is increased, the new load and new provisioning requirements are automatically accounted for. Clients will automatically level the load and distribute a fair share

of the network server load to the new server according to load sharing algorithms. Broadcast messages from a new network server may let clients know of its presence, capabilities, and availability. Existing clients need not be shifted to, and restricted to, using the new network server.

The foregoing description of a preferred embodiment of the invention has been presented for the purpose of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Obvious modifications or variations are possible in light of the above teachings. The embodiment was chosen and described to provide the best illustration of the principles of the invention and its practical application, and to enable one of ordinary skill in the art to utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. All such modifications and variations are within the scope of the invention as determined by the appended claims when interpreted in accordance with the breadth to which they are fairly, legally, and equitably entitled.

Claims

What is claimed is:

1. A method for network service negotiation in a telecommunications system, the method comprising the steps of:

in a service assignment controller coupled to a network, receiving server capability information relating to a plurality of network service elements coupled to the network;

selecting one of the plurality of network service elements in response to the received server capability information; and

sending a service request to the selected one of the plurality of network service elements.

2. The method for network service negotiation according to claim 1 wherein the step of receiving server capability information relating to a plurality of network service elements coupled to the network further includes monitoring server capability information broadcast on the network from one of the plurality of network service elements.

3. The method for network service negotiation according to claim 1 wherein the step of receiving server capability information relating to a plurality of network service elements coupled to the network further includes the steps of:

broadcasting a request for server capability information to the plurality of network service elements coupled to the network; and

receiving server capability information of the plurality of network service elements in response to the request.

4. The method for network service negotiation according to claim 1 wherein the step of receiving server capability information relating to a plurality of network service elements coupled to the network further includes the steps of:

broadcasting a request for server capability information to the plurality of network service elements coupled to the network;

selecting a selected one of the plurality of network service elements in response to the plurality of network service elements communicating server capability information; and

notifying transceiver of the selected one of the plurality of network service elements.

5. The method for network service negotiation according to claim 1 wherein the step of receiving server capability information relating to a plurality of network service elements coupled to the network further includes the steps of:

requesting server capability information from a service assignment controller coupled to the network, wherein the service assignment controller monitors server capability information of the plurality of network service elements; and

receiving server capability information from the service assignment controller.

6. The method for network service negotiation according to claim 1 wherein the server capability information includes server loading information.

7. The method for network service negotiation according to claim 1 wherein the server capability information includes service specification information that describes a service offered by one of the plurality of network service elements.

8. The method for network service negotiation according to claim 1 wherein the server capability information includes network information that describes how to communicate with one of the plurality of network service elements.

9. The method for network service negotiation according to claim 1 wherein the step of selecting further includes selecting one of the plurality of network service elements in response to received server capability information relating to a load of one of the plurality of network service elements.

10. A system for network service negotiation in a telecommunications system, the method comprising the steps of:

means, in a service assignment controller coupled to a network, for receiving server capability information relating to a plurality of network service elements coupled to the network;

means for selecting one of the plurality of network service elements in response to the received server capability information; and

means for sending a service request to the selected one of the plurality of network service elements.

11. The system for network service negotiation according to claim 10 wherein the means for receiving server capability information relating to a plurality of network service elements coupled to the network further include means for monitoring server capability information broadcast on the network from one of the plurality of network service elements.

12. The system for network service negotiation according to claim 10 wherein the means for receiving server capability information relating to a plurality of network service elements coupled to the network further includes:

means for broadcasting a request for server capability information to the plurality of network service elements coupled to the network; and

means for receiving server capability information of the plurality of network service elements in response to the request.

13. The system for network service negotiation according to claim 10 wherein the means for receiving server capability information relating to a plurality of network service elements coupled to the network further includes:

means for broadcasting a request for server capability information to the plurality of network service elements coupled to the network;

means for selecting a selected one of the plurality of network service elements in response to the plurality of network service elements communicating server capability information; and

means for notifying transceiver of the selected one of the plurality of network service elements.

14. The system for network service negotiation according to claim 10 wherein the means for receiving server capability information relating to a plurality of network service elements coupled to the network further includes:

means for requesting server capability information from a service assignment controller coupled to the network, wherein the service assignment controller monitors server capability information of the plurality of network service elements; and

means for receiving server capability information from the service assignment controller.

15. The system for network service negotiation according to claim 10 wherein the server capability information includes server loading information.

16. The system for network service negotiation according to claim 10 wherein the server capability information includes service specification information that describes a service offered by one of the plurality of network service elements.

17. The system for network service negotiation according to claim 10 wherein the server capability information includes network information that describes how to communicate with one of the plurality of network service elements.

18. The system for network service negotiation according to claim 10 wherein the means for selecting further includes means for selecting one of the plurality of network service elements in response to received server capability information relating to a load of one of the plurality of network service elements.

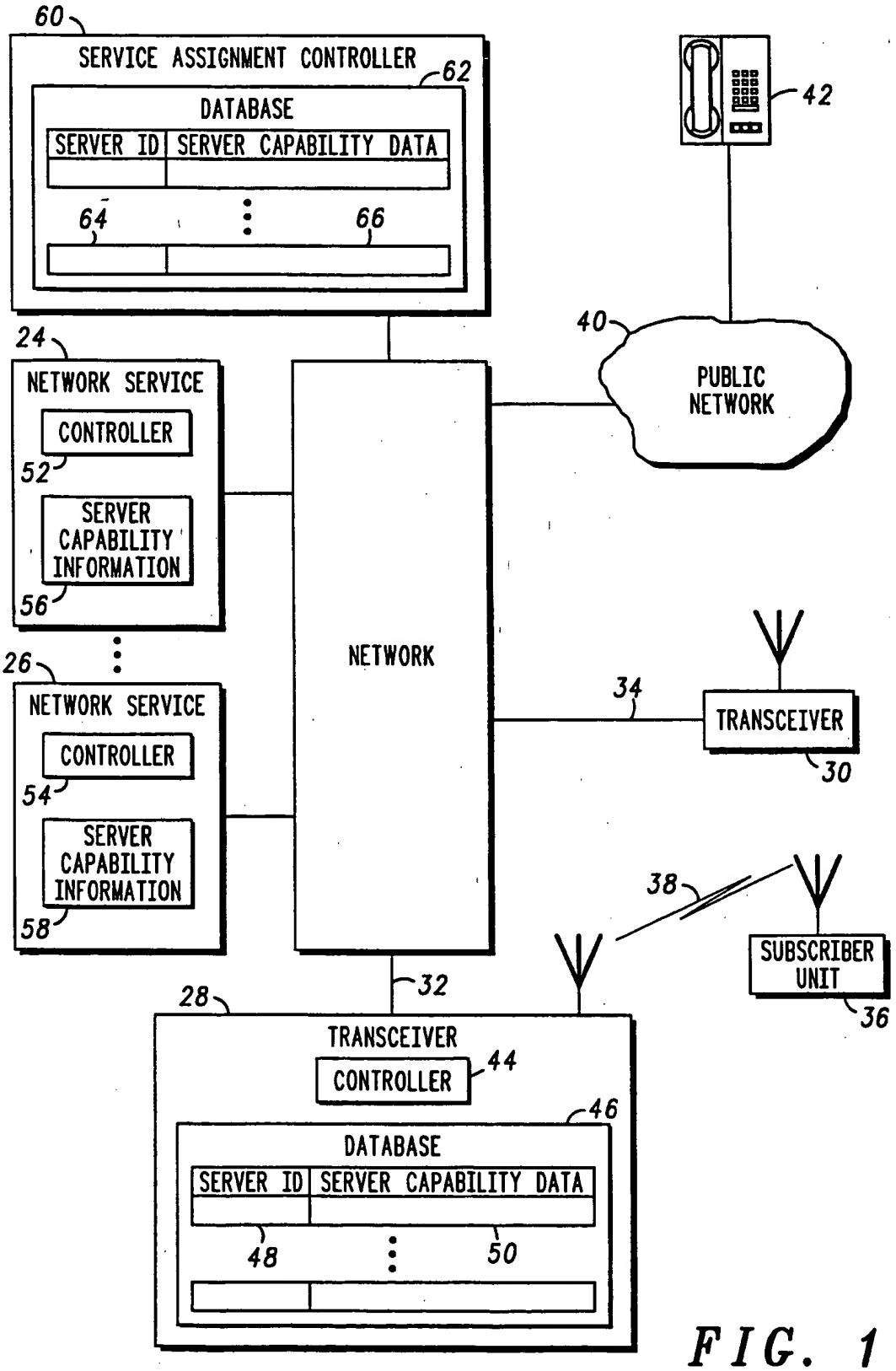
60
SERVICE ASSIGNMENT CONTROLLER
62
DATABASE
SERVER ID
SERVER CAPABILITY DATA
64
66
42
40
PUBLIC NETWORK
24
NETWORK SERVICE
CONTROLLER
52
SERVER CAPABILITY INFORMATION
56
26
NETWORK SERVICE
CONTROLLER
54
SERVER CAPABILITY INFORMATION
58
NETWORK
34
TRANSCEIVER
30
38
SUBSCRIBER UNIT
36
32
28
TRANSCEIVER
CONTROLLER
44
46
DATABASE
SERVER ID
SERVER CAPABILITY DATA
48
50

FIG. 1

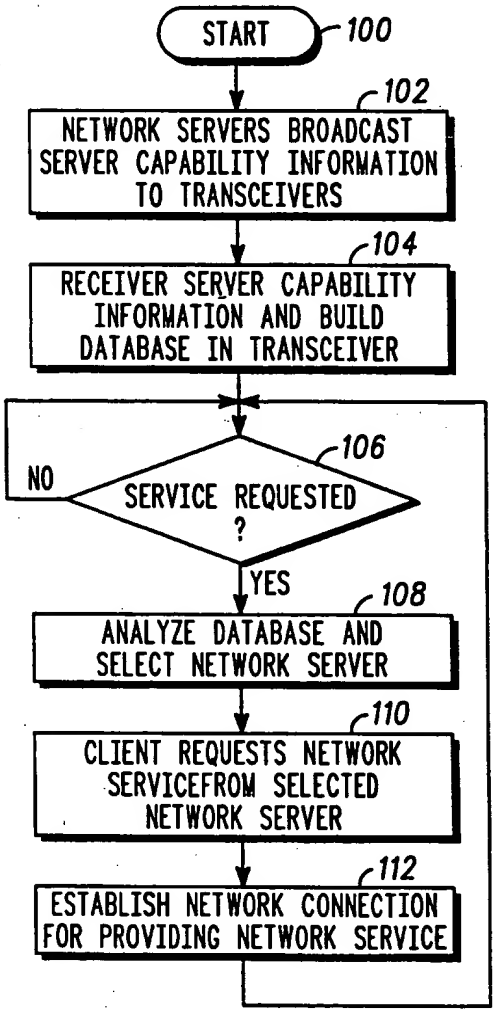
START
100
NETWORK SERVERS BROADCAST SERVER CAPABILITY INFORMATION TO TRANSCEIVERS
102
RECEIVER SERVER CAPABILITY INFORMATION AND BUILD DATABASE IN TRANSCEIVER
104
NO
SERVICE REQUESTED ?
106
YES
ANALYZE DATABASE AND SELECT NETWORK SERVER
108
CLIENT REQUESTS NETWORK SERVICEFROM SELECTED NETWORK SERVER
110
ESTABLISH NETWORK CONNECTION FOR PROVIDING NETWORK SERVICE
112

FIG. 2

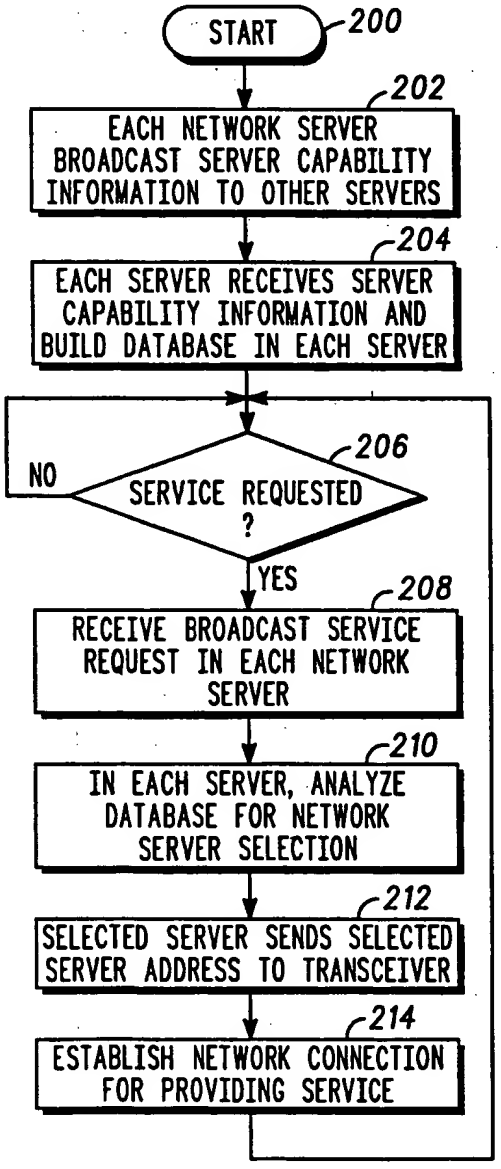
START
200
EACH NETWORK SERVER BROADCAST SERVER CAPABILITY INFORMATION TO OTHER SERVERS
202
EACH SERVER RECEIVES SERVER CAPABILITY INFORMATION AND BUILD DATABASE IN EACH SERVER
204
NO
SERVICE REQUESTED ?
206
YES
RECEIVE BROADCAST SERVICE REQUEST IN EACH NETWORK SERVER
208
IN EACH SERVER, ANALYZE DATABASE FOR NETWORK SERVER SELECTION
210
SELECTED SERVER SENDS SELECTED SERVER ADDRESS TO TRANSCEIVER
212
ESTABLISH NETWORK CONNECTION FOR PROVIDING SERVICE
214

FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/11758

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) :HO4L 12/50, 12/28; HO4M 3/00
US CL :370/385, 401, 465; 379/265, 266
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
U.S. : 370/385, 401, 465; 379/265, 266

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EAST, WEST
search terms: gateway, ss7, internet, IP, signalling, service capability

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,434,852 A (LA PORTA et al) 18 July 1995, col 8, lines15-56.	1-18
A	US 5,742,675 A (KILANDER et al) 21 April 1998, see fig 1.	1-18
A,E	US 6,072,806 A (KHOURI et al) 06 June 2000, see figs 4 and 5.	1-18

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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